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NASA-07600 (June 2004)

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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Superseding NASA-07600 (December 2003)

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DIVISION 07 - THERMAL AND MOISTURE PROTECTION

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06/04

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NATIONAL AERONAUTICS **NASA**
AND SPACE ADMINISTRATION **Superseding NASA-07600**
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SECTION 07600

FLASHING AND SHEETMETAL
06/04

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NOTE: Delete, revise, or add to the text in this section to cover project requirements. Notes are for designer information and will not appear in the final project specification.

This broadscope section covers metal roof flashing; cap, counter, and base flashing; formed metal gravel stops; gutters and downspouts; metal edges and reglets; scupper linings; and flashing for projections through roof.

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PART 1 GENERAL

1.1 REFERENCES

****

NOTE: The following references should not be manually edited except to add new references. References not used in the text will automatically be deleted from this section of the project specification.

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The publications listed below form a part of this section to the extent referenced:

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2004) Structural Welding Code - Steel
AWS D1.2	(2003) Structural Welding Code Aluminum

ASTM INTERNATIONAL (ASTM)

ASTM A 167	(1999) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A 240/A 240M	(2004) Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels

ASTM A 480/A 480M	(2004) Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip
ASTM A 653/A 653M	(2003) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 924/A 924M	(1999) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B 209/B 209M	(2004) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 224	(1998) Standard Classification of Coppers
ASTM B 32	(2003) Standard Specification for Solder Metal
ASTM B 370	(2003) Standard Specifications for Copper Sheet and Strip for Building Construction
ASTM C 920	(2002) Standard Specification for Elastomeric Joint Sealants
ASTM D 4586	(2000) Standard Specification for Asphalt Roof Cement, Asbestos Free

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1793	(2003) Architectural Sheet Metal Guideline

1.2 SUBMITTALS

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NOTE: Review submittal description (SD) definitions in Section 01330, "Submittal Procedures," and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control. Include a columnar list of appropriate products and tests beneath each submittal description.

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The following shall be submitted in accordance with Section 01330, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings

Fabrication drawings for the following items shall include material, description, and thickness.

Installation drawings shall indicate location, dimensions,

configuration, construction details, type of seams and fastening method for the following items:

Fabrication and installation drawings for accessories shall be in accordance with paragraphs entitled, "Minimum Dimensions and Thicknesses" and "Miscellaneous Components," and shall meet all design specifications as required by referenced standards within this section.

Flashing
Sheet Metal

SD-07 Certificates

Certificates for the following items shall be submitted showing conformance with referenced standards contained in this section.

Fasteners
Solder Materials
Cement
Sealing Compound

Certificates for the following types of sheetmetal shall be submitted showing conformance with referenced standards contained in this section.

Aluminum

Galvanized Steel
Copper

1.3 GENERAL REQUIREMENTS

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NOTE: If Section 05095, "Welding Steel Construction," is not included in the project specification, applicable requirements therefore should be inserted and the following paragraph deleted.
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[Section 05095, "Welding Steel Construction," applies to work specified in this section.]

PART 2 PRODUCTS

2.1 SHEET METAL MATERIALS

2.1.1 Aluminum

Sheet and strip aluminum shall be Alclad [3003] [3004] [3005] conforming to ASTM B 209/B 209M, embossed finish, clad one side and specified temper. Minimum tensile strength shall be 23,000 psi 160 Megapascal.

2.1.2 Galvanized Steel

Galvanized steel sheet shall conform to ASTM A 924/A 924M and ASTM A 653/A 653M, regular coating, designation Z90.

2.1.3 Corrosion-Resistant Steel

Corrosion-resistant steel shall be chromium-nick le steel conforming to [ASTM A 167] [ASTM A 240/A 240M], Type [_____], and ASTM A 480/A 480M, No. 2D finish, annealed temper as required for the end use.

2.1.4 Copper

Copper shall be standard [electrolytic tough-pitch copper, Type ETP] [fire-refined tough-pitch copper, Type FRTP] as classified in ASTM B 224 and conforming to ASTM B 370, cold-rolled temper.

2.1.5 Minimum Dimensions and Thicknesses

Materials shall be in accordance with SMACNA 1793 and shall be not less than the following minimum thicknesses and weights.

ITEM	COPPER, OUNCES PER SQ FT	ALUMINUM, THICKNESS INCH	CORR0-SION-RESIS-TANT STEEL, GAGE	GALVAN-IZED STEEL, GAGE	LEAD LB PER SQ FT
Building expansion joints, cap	16	0.032	28	26	---
Bellows or flanges, U-type	16	---	28	26	---
Flashings					
Base	20	0.032	28	22	3
Cap, roof pene-tration cap flashing, equip-ment and structural supports, pitch pans	16	0.032	28	26	2-1/2
Through-wall, above roof line, including coping and parapet	16	---	28	26	2-1/2
Cleats, 2 inches by 3 inches	16	0.032	26	24	---
Edge strips, 1-1/4 inches wide	24	0.050	24	20	---
Reglets	10	---	30	30	---
Cap flashing receivers	16	---	28	26	---
Gravel stop fascias:					
Corrugated sheets	16	0.032	28	26	---

ITEM	COPPER, OUNCES PER SQ FT	ALUMINUM, THICKNESS INCH	CORR0-SION-RESIS-TANT STEEL, GAGE	GALVAN-IZED STEEL, GAGE	LEAD LB PER SQ FT
Smooth sheets to 3-1/2 inches	16	0.032	28	26	---
Smooth sheets over 3-1/2 inches	20	0.050	26	22	---
Gutters and downspouts:					
Gutter sections, end caps	16	0.032	28	26	---
Continuous cleats, cover plates	16	0.032	28	26	---
Downspouts, conductor heads	16	0.024	30	26	---
Scupper linings	20	0.032	28	26	---
Strainer wire gage/diameter	No. 9	0.144 dia.	0.109 dia.	0.12 dia.	---
Downspout hangers, 2 inch	1/8 inch	0.125	18	10	---
Gutter hangers, 1 inch wide	1/8 inch	0.125	18	10	---
Splash pans	16	0.040	28	22	3

ITEM	COPPER, KG PER SQUARE METER	ALUMINUM, THICKNESS MILLIMETER	CORROSION RESISTANT STEEL THICKNESS MILLIMETER	GALVANIZED STEEL THICKNESS MILLIMETER	LEAD KG PER SQUARE METER
Building expansion joints, cap	4.9	0.81	0.48	0.55	---
Bellows or flanges, U-type	4.9		0.48	0.55	---
Flashings					
Base	6.1	0.81	0.48	0.85	14.6
Cap, roof penetration cap flashing, equipment and structural supports, pitch pans	4.9	0.81	0.48	0.55	12.2
Through-wall, above roof line,	4.9	---	0.48	0.55	12.2

ITEM	COPPER, KG PER SQUARE METER	ALUMINUM, THICKNESS MILLIMETER	CORROSION RESISTANT STEEL THICKNESS MILLIMETER	GALVANIZED STEEL THICKNESS MILLIMETER	LEAD KG PER SQUARE METER
including coping and parapet					
Cleats, 50 by 75 millimeter	4.9	0.81	0.55	0.70	---
Edge strips, 32 millimeter wide	7.3	1.27	0.70	1.0	---
Reglets	3.1	---	0.40	0.40	---
Cap flashing receivers	4.9	---	0.48	0.55	---
Gravel stop fascias:					
Corrugated sheets	4.9	0.81	0.48	0.55	---
Smooth sheets to 90 millimeter	4.9	0.81	0.48	0.55	---
Smooth sheets over 90 millimeter	6.1	1.27	0.55	0.85	---
Gutters and downspouts:					
Gutter sections, end caps	4.9	0.81	0.48	0.55	---
Continuous cleats, cover plates	4.9	0.81	0.48	0.55	---
Downspouts, conductor heads	4.9	0.61	0.40	0.55	---
Scupper linings	6.1	0.81	0.48	0.55	---
Strainer wire diameter		3.66 dia.	2.77 dia.	3.0 dia.	---
Downspout hangers, 50 mm	3.2 mm	3.18	1.3	3.5	---
Gutter hangers, 25 mm wide	3.2 mm	3.18	1.3	3.5	---
Splash pans	4.9	1.02	0.48	0.85	14.6

2.2 CEMENTS AND SEALING COMPOUNDS

2.2.1 Bituminous Plastic Cement

Bituminous plastic cement shall be an asphaltic-base material conforming to ASTM D 4586, compatible with the roofing asphalts and asphalt primer.

2.2.2 Sealing Compound

Sealant shall be on elastomeric, [(Type S) single] [(Type M) multiple] -component, nonsag or gunnable (Grade NS) Class 50 sealant, conforming to ASTM C 920. Base material shall be polysulfide.

Aluminum-seam sealant shall be as recommended by the aluminum manufacturer.

2.3 SOLDER MATERIALS

Solder and flux shall meet the requirements of ASTM B 32. Solder shall be

SN50.

2.4 FASTENERS

Fasteners shall be the same metal or a metal compatible with the material joined.

2.5 MISCELLANEOUS COMPONENTS

Conductor heads shall conform to SMACNA 1793, Plate [_____], Figure [_____], and shall be fabricated of the same material and thickness as the downspout. Seams shall be locked and soldered.

Metal scupper linings conforming to SMACNA 1793, Plate [_____], shall be provided through wall and roof openings.

Metal splash pans conforming to SMACNA 1793, Plate [_____], Alternate Section 2, shall be provided. Material shall be the same for downspouts.

PART 3 EXECUTION

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NOTE: Specifier should coordinate specifications with drawings so that drawing details and SMACNA 1793, Plate requirements do not conflict or repeat. SMACNA 1793, Plate requirements should be eliminated from specifications if covered on drawings.

****

3.1 GENERAL

Sheetmetal work shall conform to drawing details and to the applicable plate number and design and installation recommendations of SMACNA 1793. Finished sheetmetal installation shall be free from water leakage.

Surfaces to receive sheetmetal work shall be clean, smooth, dry, and free from defects and projections which might affect the work. Surfaces shall be plumb and true to a tolerance of not more than 1/2 inch in 40 feet 13 millimeter in 12.2 meter, with no dips, waves, or uneven surfaces exceeding 1/8 inch in 10 feet 3.2 millimeter in 3000 millimeter in any direction. Lines, arises, and angles shall be sharp and uniform. Exposed edges of sheetmetal shall be folded back to form a 1/2-inch 13 millimeter wide hem on the concealed side.

3.1.1 Fastening Methods

Fasteners shall be concealed. Only one edge shall be nailed to permit freedom of expansion perpendicular to the line of nailing. Nails shall be spaced at not more than 3 inches 75 millimeter on center. Nails shall penetrate backing by not less than 1 inch 25 millimeter.

Cleats shall be used for securing edges of sheetmetal members over 12-inches 300 millimeter wide and at other designated locations. Cleats shall be fastened with two nails and the end folded over the nails. Other end of the cleat shall be locked into the seam or the folded edge of member being fastened. Cleats shall be spaced at not more than 12 inches 300 millimeter on center.

Screws shall be fitted with [neoprene] [lead] washers to protect surface of

metal sheet and provide a watertight connection.

3.1.2 Seams

Seams and lock joint construction shall conform to SMACNA 1793, Plates [99] [100].

Seams shall be straight and uniform in height, width, and finish as follows:

Flat-lock seams shall be not less than 3/4-inch 19 millimeter wide.

Lap seams, when soldered, shall finish not less than 1-inch 25 millimeter wide.

Lap seams, not soldered, shall overlap not less than 3 inches 75 millimeter.

Joints, seams, and connections of copper shall be soldered except where other methods of joining are indicated.

Joints, seams, and connections of aluminum shall be welded except where a screw or riveted and hard-setting sealant connection is indicated.

Loose-lock expansion seams shall be not less than 3-inches 75 millimeter wide and shall provide for not less than a 1-inch 25 millimeter movement within the joint. Joint shall be completely filled with the specified sealant applied at not less than 1/8-inch 3.2 millimeter bed thickness.

Flat seams shall be made in the direction of flow. Seams not soldered shall be completely filled with plastic cement.

Surfaces to be joined by soldering shall be cleaned, pretinned, heated, fluxed, and sweat-soldered through the full contact area in accordance with the best standards of practice in modern sheet metal shops. Flux residue and foreign matter shall be removed after soldering. Soldered surfaces shall be rinsed with water and wiped clean.

Procedures for manual shielded metal-arc welding, the appearance and quality of welds made, and the methods used in correcting welding work shall conform to AWS D1.1/D1.1M and AWS D1.2.

3.1.3 Provisions for Expansion and Contraction

Expansion-joint configuration shall conform to the drawing details and to SMACNA 1793, Plate [_____].

Expansion joints in concrete walls shall conform to SMACNA 1793, Plate [____]. Each member shall not exceed 10 feet 3000 millimeter in length and shall run continuously from the top of the footing to the top of the wall.

Floor slab expansion joints shall conform to SMACNA 1793, Plate [_____]. Joints shall be lapped 3/4 inch 19 millimeter and soldered prior to installation in the concrete floor slab.

3.1.4 Dissimilar Metals

Dissimilar metals shall be isolated from each other by painting with bituminous paint.

3.2 FLASHING

3.2.1 Reglets and Flashing Receivers

Reglets and flashing receivers shall conform to SMACNA 1793, Plate [_____]. Masonry joints or concrete shall be cut to form a saw-cut reglet. Slots shall be cut to a depth not less than 1-1/2 inches 38 millimeter and approximately 3/16-inch 0.19 millimeter thick.

3.2.2 Base Flashing

****
NOTE: This paragraph is not applicable for built-up roofing.
****

Metal base flashing shall be installed where the roof abuts vertical surfaces, in valleys, at ridges, and where the roof slope changes. Configuration shall conform to SMACNA 1793, Plate [_____].

Flashing shall extend not less than 8 inches 200 millimeter up vertical surfaces.

3.2.3 Cap and Counter Flashing

Metal cap or counter flashing shall be installed where horizontal roof surfaces abut vertical wall surfaces, at copings, at joints between existing and new construction, at penetrations of roof surfaces, and at equipment supports. Configuration shall conform to SMACNA 1793, Plate [_____].

Flashing shall be formed in 10-foot 3000 millimeter lengths, except where shorter pieces are required; end joints shall be lapped not less than 3 inches 75 millimeter. Joints shall not be soldered.

3.2.4 Edge Strips

Edge trim strips shall have a formed drip edge.

3.2.5 Flashing at Roof Penetrations and Equipment Supports

Metal flashing conforming to SMACNA 1793, Plate [_____], shall be installed where piping, conduit, or equipment supports penetrate roof surfaces.

Single-pipe vents shall be flashed with lead flashing or a two-piece formed-metal housing of the specified sheetmetal, installed as indicated in SMACNA 1793, Plate [_____].

3.2.6 Pitch Pans

****
NOTE: Pitch pans are a maintenance item. Consider use of pre-manufactured pipe flashings and pre-manufactured flashings for roof penetrations.
****

A metal pitch pan conforming to SMACNA 1793, Plate [_____], shall be installed where structural members, anchors, and equipment supports

penetrate roof construction.

Pan shall be installed over the final roofing ply. Flanges shall be set in bituminous plastic cement and shall receive two plies of stripped-in composition flashing.

3.3 GRAVEL-STOP FASCIAS

Gravel-stop fascias shall be installed at exposed edges of built-up roofs. Configuration shall conform to SMACNA 1793, Plate [_____]. Lower edge of each gravel-stop fascia section shall be secured in place by hooking over a continuous edge strip or cleat. Flanges of each section shall extend out on the top of roofing felts not less than 3-1/2 inches 90 millimeter.

A 1/4-inch 6 millimeter open joint shall be provided between each gravel-stop fascia section, with a 12-inch 300 millimeter wide plate centered on the joint. System shall be installed in accordance with SMACNA 1793, Plate [_____].

3.4 GUTTERS AND DOWNSPOUTS

3.4.1 Gutters

Gutter design shall be in accordance with SMACNA 1793, Plate [_____].

Gutters shall be set level to a tolerance not to exceed 1/2 inch in 40 feet 13 millimeter in 12.2 meter.

Gutters shall be pitched to drain at not more than 1/16 inch per foot 1.6 millimeter in 305 millimeter.

Gutters supports shall be in accordance with SMACNA 1793, Plate [_____]. Support spacing shall not exceed 30 inches 760 millimeter on center.

Back edges of gutters shall be folded to form a continuous hook not less than 1/2-inch 13 millimeter deep. Gutters shall be supported by continuous cleat of not less than a 2-1/2-inch 64 millimeter width.

Outlet tubes with flanges shall be riveted and soldered to gutters; tubes shall be extended 3 inches 75 millimeter into downspouts.

A downspout strainer shall be inserted into each outlet tube.

Gutter expansion joints shall be provided at a spacing of not more than 32 feet 9.75 meter on center in accordance with SMACNA 1793, Plate [_____].

3.4.2 Downspouts

Downspouts shall be provided on outside walls from gutters, conductor heads, and scuppers.

Downspouts shall be joined to the gutters at outlet tubes and joined to each other by telescoping end joints 1-1/2 inches 38 millimeter into the lower section.

Downspout hangers shall be fabricated of the same material as downspouts. One hanger shall be provided at the top and bottom of each downspout section.

Elbows shall be installed where downspouts terminate on splash blocks or roof pans. Downspouts shall be fitted neatly into cast-iron boots or drain pipes where downspouts terminate in drainage lines; joints shall be filled to the full height of the bell with portland-cement mortar caps.

3.5 MISCELLANEOUS DRAINAGE ITEMS

3.5.1 Conductor Heads

Installation shall be in accordance with SMACNA 1793, Plate [_____].

Top openings shall be closed with removable 1/2-inch 13 millimeter mesh screens.

3.5.2 Scupper Lining

Linings shall be projected beyond walls or fascias and terminated in conductor heads, spouts, or overflow openings. Surfaces to receive linings shall be coated with bituminous cement.

3.6 CLEANING

Exposed sheetmetal work shall be cleaned of all surface contaminants and imperfections at completion of installation.

-- End of Section --